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Section 1

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Labor Classification and Payroll Analysis

By

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Editorial Department Note

In many organizations the information available through the accounting records is very meagerly untilized excepting as it is needed in the routine accounting procedures. While very necessary and valuable for that purpose, the chief value of such information is oftentimes lost because of a lack of appreciation of the many ways in which it may be used by various executives in supplying them with factual data or effective measuring sticks with which to formulate the policies and see them properly executed.

Our current publication points out an important added use which can be made of payroll and labor information and is a significant contribution to this field of thought. The author, Carleton F. Brown, was born in 1882, at Elizabeth, New Jersey. He attended the Pingry School of that city and St. Paul's School of Concord, New Hampshire. In 1904 he graduated as a Civil Engineer from the Rensselaer Polytechnic Institute, in Troy, New York.

Among his early business connections were those with the Electro-Metallurgical Company of Niagara Falls and the J. P. Divine Company of Buffalo, New York.

In 1909 he became associated with the Hon. Ben Conger of Groton, New York, in the organization and development of the Standard Typewriter Company, manufacturing and selling the Standard Folding Typewriter. Subsequently the name of the machine was changed to Corona and the name of the company became the Corona Typewriter Company, Inc. From the beginning Mr. Brown occupied the position of Treasurer and General Manager of the organization and was naturally a member of the Board of Directors and Executive Committee. Upon the consolidation of the Corona and L. C. Smith organizations he was elected Vice-President in charge of production and a member of the Board of Directors.

This paper was presented before a recent meeting of our Rochester Chapter.

LABOR CLASSIFICATION AND PAYROLL ANALYSIS

In the beginning, the practice of cost accounting tended to concern itself almost entirely with the determination of costs for the purpose of establishing the proper selling price or for checking with previously submitted estimates. The functions of the cost keeping department have within recent years, however, developed to such an extent as to almost subordinate its original objective to that of fact finding for control purposes. The cost accountant of today has, therefore, to concern himself more with the daily details and problems of management than was the case in the past, where certain data were periodically gathered together and presented to the management as a general summary of the factory's operations over a given period, or for a given lot of work.

All costs are the results of causes, many of which have occurred a long time prior to the determination of the cost. Each of these

causes necessarily has its influence upon the final cost, and if these causes can be properly measured and their relative importance properly adjusted in advance, the management is in position to influence directly the final cost which will be given by the Cost Department. The natural and logical source of information concerning these problems is the Cost Department, and the cost accountant should have a proper conception of the problems of management, apart from the mere findings of costs, in order to perform his work most efficiently. He must constantly remember that cost finding and fact finding are two different things and in some cases have two different objectives. In the determination of facts it may frequently occur that the information so obtained and its bearing on factors in the business are not in direct line with the ascertainment of cost. For instance, the analysis of pay roll is entirely separate and distinct from its distribution, and yet from a managerial standpoint the analysis from a fact-finding standpoint may be as important as distribution from the cost standpoint.

Most managers of business enterprises have the habit of speaking of productive and non-productive labor, but in so speaking are governed very largely, if not entirely, by the definitions of these terms heretofore laid down by cost accountants to suit the convenience or necessities of pay roll distribution for cost finding. In a very general sense the average manufacturer thinks of productive labor as that labor which works directly upon the product, and of non-productive as composed of all others, such as clerks, millwrights, firemen, and so forth. Cost accountants, realizing that the terms "productive" and "non-productive," are not truly descriptive of the manner in which they distribute labor, have in certain instances used the terms "direct" and "indirect" as more or less synonymous with the older words and more truly indicative of the definitions which they give, productive or direct labor in general being defined as that labor which may be applied directly to the product, and non-productive or indirect that which cannot readily be so applied, but must be distributed over all processes of manufacture through burden charges.

There has been of late a tendency to take exception to the use of the words "productive" and "non-productive," but so far from a practical standpoint I have heard suggested no words which so clearly convey to the manufacturer the idea of these two divisions of his payroll as do these. However, it is after all not a question so much of words as of definitions. Unfortunately, we have apparently been unable to hit upon some commonly accepted rule by which we might divide our payroll into these two groups and still feel confident that our comparisons or our resulting ratios of whatsoever nature may be compared with corresponding figures of other manufacturers or industries or even with those of our own business over any extended period of years.

At our Groton Plant, where the Corona Typewriter is made, we have for several years past now used the following definitions:

The word, "labor," is to be accepted in its broadest sense and includes every individual normal to manufacturing operations from the Works Manager or Superintendent down. This interpretation is equally true of the use of the word, "payroll." Methods of pay, whether by the hour, day, week or month, are ignored.

Productive Labor is that labor which involves physical effort of any nature whatsoever, which produces or tends to produce:—

1. Any change in raw material, finished or semi-finished parts or product in process of manufacture, as to form, character, quality or dimension of such material or product for the purpose of rendering such material or product useful, or preparing it for the subsequent processes or operations tending to ultimate usefulness. Such physical effort may be applied directly, or its application may be through the intermediation of power machinery or chemical or other processes.

2. Any change whereby a given piece of material, article or structure of any kind is:

a. Increased in value
b. Increased in usefulness
c. Maintained in a practical state of utility.

N.B. The term, "manufacture," refers to all processes commonly known in any industry as direct manufacturing processes and is not limited to the direct manufacturing processes of the particular industry in question.

We feel, however, that such a definition does not satisfactorily solve our entire problem with respect to labor classification. Nor is it to be hoped that any definition along these lines alone will do so. Because of the misleading character of the results obtained in all our own attempts to divide labor into two major groups, such as "productive" and "non-productive," we finally reached the conclusion that any such limited analysis would always be unsatisfactory and that other divisions are necessary—not sub-divisions of the major ones, but divisions along entirely different lines of cleavage. This second system of grouping comprises three divisions, and we have, because of the aptness of the words, dared to risk the displeasure of cost accountants by using the terms, "direct," "indirect," and "general" to classify them.

Direct Labor is that labor, whether productive or non-productive, which applies itself directly to the product, the manufacture of which is the primary purpose of the organization, or the labor of non-productive individuals or departments whose efforts are auxiliary to the productive processes of direct productive departments as sole beneficiaries.

Indirect Labor is that labor, productive or non-productive, essential to productive processes other than but supplemental to processes of direct labor.

General Labor comprises all labor not falling wholely within one of the clasifications, direct or indirect.

If the use of the words, "Direct" and "Indirect," is seriously objected to, other words, such as manufacturing and supplementary might be substituted. Mr. William S. Kemp, while President of the Boston Chapter of the National Association of Cost Accountants, during the chapter year 1922-1923, delivered a series of very interesting talks to the Boston Chapter on the subject of departmental and standard costs. A part of his general plan was the dividing of all departments into two groups, productive and non-productive. Among the departments appearing in the productive or direct labor group are found, among others, packing, tool, development, and drafting. Mr. Kemp admits that in a measure these departments are non-productive or indirect labor departments, but he groups them in that manner for the purpose of giving them the same general overhead expenses as the direct labor departments, and says in support of the practice of giving them this burden charge: "For instance, the tool making department has just the same kind of overhead expense while making tools, dies and so forth for us as it would have if the company were making these same tools and dies for sale." He also states that in the development department much of the work done is the manufacture of special articles for sale, and there should, therefore, be the same general application of expense burden to them as in the case of regularly manufactured products. Mr. Kemp is referring in his talks specifically to the system used in the Holtzer-Cabot Electric Company.

The inference to be drawn from the remarks made with respect to the tool making department and the development department would seem clearly to support the theory stated above with respect to the division of manufacturing activities into direct and indirect, and to substantiate the contention that the division of any business into two groups, such as "productive" and "non-productive," or whatever other names you choose to give them, is not sufficient, but that horizontal as well as vertical lines of demarcation must be used to secure a proper picture of our pay roll. Mr. Kemp could easily differentiate his departments into Productive, Direct and Indirect, and Non-Productive, Direct and Indirect, and his Tool Room and similar departments could then be readily and logically placed without confusion. I wish to emphasize that such divisions of our labor or our pay roll are merely analytical and not at all distributory. Much of the money which we put into our manufacturing expense accounts never appears there as labor at all but is hidden in some expense items, and except through an analysis of the payroll we have no way of knowing to what extent each dollar of payroll is expended between the various labor activities of the enterprise.

That cost experts, in some cases at least, realize the necessity for reports covering payroll information of various kinds is evidenced by a very comprehensive article on "Cost Accounting to Aid Production" by G. Charter Harrison, appearing in *Industrial Man-*

agement in 1918. It emphasizes the necessity for a summarized payroll report showing, among other things, such items as:

1. Number of employees on roll.
2. Number of employees absent or working short hours, and total hours so lost.
3. Actual hours worked by operators.
4. Payroll of operators.
5. Average rate per hour of operators.
6. Hours worked other than by operators.
7. Payroll of employees other than operators.
8. Average rate per hour of such employees.
9. Total hours worked by all employees.
10. Average rate per hour earned by all employees.

Each of us, striving independently to prepare for ourselves reports of such a nature, might and probably would under absolutely identical conditions arrive at varying results because of the individual interpretations which each might put upon the classification of his employees. As a very broad picture of how information of this nature might be obtained, let me cite the following tabulation, which is purely arbitrary:

Tabulation

Total payroll	$100,000	100%
A. Total prod. payroll.....	61,600	61.6%
1. Production direct	58,200	58.2%
2. Production indirect	3,400	3.4%
B. Total non-prod. payroll.....	38,400	38.4%
1. Non-prod. direct	21,500	21.5%
2. Non-prod. indirect	4,600	4.6%
3. Non-prod. general	12,300	12.3%
C. Total direct payroll.....	79,700	79.7%
Total indirect payroll.....	8,000	8.0%
Total general payroll.....	12,300	12.3%

These data might also be presented in terms of numbers of employees or of hours.

The same classification or analysis may be used in other ways by breaking down the non-productive activities into their various sub-divisions, such as supervision clerical and miscellaneous. Such tabulations may be applied to the business as a whole, or, if so desired, to individual departments.

As a practical illustration of the development of comparative labor data by departments, I might cite a report which we prepare, called "The Weekly Labor Analysis on Hourly Basis." This report applies solely to manufacturing or direct departments but could be modified to apply to supplementary or indirect departments. In developing this report, we were confronted with the difficulty of

L C Smith & Corona Typewriters Inc — Weekly Labor Ana

1 DEPT. NO.	2 PERIOD	PRODUCTIVE LABOR — APPLIED — PREMIUM 3 Time Allowed	4 Time Taken	DAY WORK 5 Time Allowed	6 Time Taken	7 UN-APPLIED	8 SET-UP	9 TOTAL
1	A	316.13	278.48	24.73	25.36	68.82	42.81	456.[illegible]
	B							
2	A	230.43	187.15	29.14	23.66	-	5.73	286.[illegible]
	B							
3	A	692.96	573.65	46.45	44.06	67.00	53.11	757.[illegible]
	B							
4	A	-	-	215.65	341.05	22.10	11.20	374.[illegible]
	B							
5	A	199.91	138.38	44.91	47.83	307.10	8.75	502.[illegible]
	B							
6	A	510.03	410.96	41.67	44.70	8.63	27.78	492.[illegible]
	B							
7	A	106.79	99.89	-	-	240.85	-	340.[illegible]
	B							
8	A	131.44	113.60	118.69	123.80	23.56	6.06	278.[illegible]
	B							
9	A	719.46	613.47	396.45	428.29	82.14	51.54	1175.[illegible]
	B							
11	A	757.15	537.13	85.17	82.75	6.06	8.33	654.[illegible]
	B							
27	A	14.74	10.93	737.84	718.50	83.57	-	813.[illegible]
	B							
28	A	1025.84	918.98	-	-	73.27	-	992.[illegible]
	B							
33	A	152.40	150.70	9.65	11.63	41.41	-	203.[illegible]
	B							
72	A	-	-	-	505.31	120.95	-	626.[illegible]
	B							
73	A	820.59	358.79	326.93	340.69	16.08	-	1215.[illegible]
	B							
74	A	934.76	1239.30	614.59	663.48	48.11	-	1998.[illegible]
	B							
75	A	424.38	460.34	.45	.48	141.12	2.74	604.[illegible]
	B							
	A							
	B							
	A							
	B							
	A							
	B							
	A							
	B							
TOTAL	A	7036.81	6611.75	2692.32	3406.59	1375.77	218.05	11612.[illegible]
	B							

A. Equals This Week
B. Equals Run-Average

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1. Vice President—Production
2. Factory Manager
3. Methods and Time Study—Main Office
4. Production Manager
5. Time Study—Local

FORM 1.

tying up labor analysis with labor distirbution, as I have above defined the terms, by adhering strictly to the purely analytical method without any reference to distribution. We found the solution to this problem by the division of the productive labor into applied and unapplied labor, applied labor being that productive labor which the cost accountant would charge directly to the product, and unapplied labor that productive labor which he would charge to burden for convenience or because of his inability to make a direct charge of it.

In the illustration of this report, above, the first general section is entitled "Productive Labor" and under this comes the sub-titles of "Applied," "Unapplied" and "Set-Up," this last class being considered as productive labor. There are two classifications

on Hourly Basis — Week Ending November 6, 1926

NON-PRODUCTIVE LABOR		12 TOTAL NON-PRODUCTIVE	13 TOTAL PAY ROLL	14 Premium Efficiency Rating	15 Day Work Efficiency Rating	16 Percent Applied Productive Hours on Day Work	17 Percent Productive Hours on Set-Up	18 Percent Pay Roll Hours on Non-Productive	19 Premium Hours Lost From Standard	20 Day Work Hours Lost From Standard
10 Supervision and Clerical	11 Other									
56.75	14.85	71.60	487.07	113.2% / 112.6%	97.5% / 93.6%	8.0% / 7.3%	18.3% / 12.3%	14.7% / 13.8%	9.65	.63
15.46	-	15.46	237.00	123.1% / 124.7%	101.6% / 98.7%	13.0% / 12.4%	2.6% / 2.4%	6.5% / 7.1%	-	-
67.90	18.65	86.15	843.97	120.8% / 118.2%	103.2% / 104.3%	7.0% / 8.3%	7.0% / 6.4%	10.2% / 9.8%	16.46	
51.90	8.15	59.65	434.00	-	63.2% / 89.8%	100 % / 100 %	3.0% / 3.2%	13.8% / 14.4%	-	125.40
54.65	21.94	76.59	578.65	108.5% / 129.4%	93.9% / 93.7%	25.6% / 20.3%	1.7% / 1.9%	13.1% / 12.5%	;09	2.92
35.15	4.87	40.02	532.09	124.1% / 118.9%	93.2% / 95.5%	8.0% / 6.3%	5.6% / 4.9%	7.5% / 8.3%	12.02	3.03
17.30	1.96	19.26	360.00	106.9% / 107.1%	- / -	.0% / .0%	.0% / .0%	5.3% / 5.6%	1.26	-
21.87	6.84	28.71	300.73	115.7% / 117.4%	95.8% / 91.3%	52.1% / 44.6%	2.2% / 2.7%	9.5% / 8.9%	2.04	5.11
73.45	14.21	87.66	1263.10	117.7% / 117.2%	92.5% / 94.1%	41.1% / 43.4%	4.4% / 3.2%	6.9% / 6.8%	17.74	31.84
52.14	3.69	55.83	710.10	135.2% / 129.4%	102.9% / 88.7%	12.9% / 11.6%	1.2% / 1.0%	7.9% / 7.8%	4.64	-
50.00	-	50.00	363.00	133.7% / 130.7%	102.7% / 93.5%	1.8% / 1.8%	.0% / .0%	13.8% / 14.0%	-	-
50.00	-	50.00	1042.25	111.6% / 114.2%	- / -	.0% / .0%	.0% / .0%	4.8% / 5.1%	6.01	-
15.67	9.39	25.06	228.80	101.1% / 112.8%	82.2% / 91.4%	7.1% / 11.2%	.0% / .0%	10.9% / 10.8%	8.47	1.98
52.14	12.63	64.77	691.03	-	-	100% / 100 %	.0% / .0%	9.4% / 9.4%	-	28.84
51.15	3.87	55.02	1270.58	95.6% / 107.3%	95.2% / 93.5%	28.4% / 10.8%	.0% / .0%	4.3% / 5.2%	100.46	13.76
53.38	14.62	74.00	2024.89	75.4% / 114.7%	92.8% / 103.6%	34.8% / 9.6%	.0% / .0%	3.7% / 4.1%	213.91	48.89
61.39	21.54	82.93	687.61	92.2% / 113.4%	93.7% / 91.3%	.0% / .3%	.5% / .2%	12.1% / 11.5%	67.00	.03
735.50	157.11	942.61	12554.77	106.4% / 117.9%	93.0% / 94.1%	34.0% / 21.4%	1.9% / 2.2%	7.5% / 8.1%	459.75	262.43

CONTENTS

1. Column 7 = 4+5+6+7+8
2. " " 9 = 10+11
3. " " 12 = 10+11
4. " " 13 = 3+4

1. Column 15 = 3+6
2. " 16 = 4+5+6+7+8
3. " 17 = 5+6
4. " 18 = 12+13

FORM 1—CONTINUED

under applied: "Premium" and "Day Work,"—in the case of a plant operating under piece work system, piece work would be used in place of premium—"Premium" in this instance representing that portion of the productive labor which has been time-studied and upon which the operators work under a wage incentive plan. "Day Work" in this instance represents that portion of productive labor which, while being as direct in its application as premium work, has not been time-studied and therefore cannot be worked upon under the wage incentive system, but must be paid for by the straight day work method of wage payment.

On this report each department is divided into two sections, one indicating the activities for the current week, as indicated by the letter "A," and the second, the running average, as indicated by the

letter "B." This, of course, is to allow for a better comparison of the week's work.

In Column 3, under the Premium Section, is shown the number of hours of time allowed for the product which has been produced in the department on premium.

Column 4 shows the actual number of hours taken to produce the product.

Under Column 5, in the Day Work Section, is shown the hours of time allowed for work produced in this department on day work. While this class of work as has been stated, has not been time studied and placed upon wage incentive, it is, however, estimated, first for the purpose of setting standards for standard costs, and second, so that a measurement of efficiency can be obtained on day work operations. Estimates are not set at full 100% possibilities, however, because it is not expected that a day work operator will produce at the same degree of efficiency as will an operator working on premium. Therefore, the standard as set on day work represents about 80% of the standard as established for premium.

In Column 7 is shown the total number of unapplied hours, as previously defined. This labor, although productive in its character, cannot be applied directly to the product, through inability to establish standards upon it or conveniently to distribute it directly to the product. In the Punch Press Department, for instance, are several classes of work which are general in character, barrel tumbling of parts as they come from the presses for the purpose of removing burrs or brightening being one of these. Surely this is productive labor, since the work upon the parts is just as essential to the ultimate use of the parts as is the actual blanking or forming of the parts themselves. However, inasmuch as the operator of the tumbling barrels may be working upon 12 or 15 barrels simultaneously, each containing different parts, it is most inconvenient, although not impossible, to set up standards of measurement upon his work, and it is therefore much more practical and inexpensive to charge his time to a fixed expense account such as "Unapplied Productive Labor."

"Set-Up Labor" as represented in Column 8 is considered as productive labor from the standpoint of labor analysis, but is non-productive labor from the standpoint of the cost system because of the variation of time required for setting up machines and the varying conditions surrounding different set-ups on the same part. In some plants where set-up has been time-studied and incentive rates established, it is quite proper to consider it as a regular operation and as applied productive labor.

Column 9 shows the total productive hours worked in the department, and is made up of the totals of columns 4, 6, 7 and 8.

Column 10 of the Non-productive Section is self-explanatory.

Column 11 of that section is used to show idle time and overtime on the part of operators and miscellaneous time spent around the department on non-productive work.

Columns 12 and 13 are self-explanatory.

Column 14, headed "Premium Efficiency Rating" is the departmental efficiency of the work which has been performed on premium. This is determined by dividing time allowed, as shown under Column 3, by time taken, as shown under Column 4.

Column 15, headed "Day Work Efficiency Record" is the record of the departmental efficiency on that class of work, and is determined by dividing the time allowed on day work, as shown under Column 5, by time taken, as shown under Column 6. The information shown under these two columns is of course quite imporant, inasmuch as it gives a direct check upon the departmental foremen in the handling of their operators, and it also gives the General Manager a check upon the Factory Manager as to his ability to keep the departments producing at a satisfactory efficiency.

Column 16 represents the number of hours of time taken on day work as a percentage of the total number of hours of time taken of applied productive labor in the department, or in other words, Column 6, divided by Columns 4 plus 6. This figure should be watched very closely, and constant pressure brought to bear upon the time study division for releases of all possible day work operations to premium, inasmuch as the plant suffers through inefficiency as long as productive labor remains on day work.

In Column 17 is shown the percentage which set-up labor is of the total hours of productive labor, and is secured by a division of Column 8 by Column 9. It is important as a control factor upon the planning of the production department, the efficiency of tool inspection, breakage of tools, and even of tool design.

Column 18 indicates the percentage of non-productive labor to total payroll and is secured by dividing Column 12 by Column 13. This figure is important because of the indication it gives of the trend of the labor element of overhead in the department.

Column 19 represents the extent to which operators have fallen below the 100% standard of production set by the time study. Under the 100% premium plan this is important as the amount lost indicates a direct loss in dollars, or, in other words, an increase in cost in the applied productive labor of that department. This would not be true when piece work is paid unless as with Kemp, day rates are guaranteed.

Column 20 shows the hours lost from day work standards, and is represented by the difference between time allowed and time taken on applied day work productive labor; i. e., Column 6 minus Column 5.

This particular report sums up on one sheet the labor activities of the entire direct productive or manufacturing departments, and is used by both the general management and factory management as a guide to the control of all manufacturing processes. The details of these figures are given periodically to those in charge of the operating departments so that they may have first hand information through which they can secure direct control of their respec-

tive departments. The executive in charge of production uses this report as a check on the factory manager, inasmuch as by careful study from week to week, he can follow very definitely the trend of labor conditions in the plant.

It is my opinion that analyses, such as those suggested, or others of a similar nature which might be developed, are of great benefit to the general management and the plant manager. Data are promptly and periodically supplied, which perhaps have never been available in the past under the cost method of labor distribution. In my own experience I have frequently struggled with the complexities of the activities of plant personnel as partially represented by the direct labor payroll and partially by the non-productive labor shown in the manufacturing expense report, and rarely, if ever, with satisfactory results.

This Labor Analysis report, combined with others controlling the indirect or supplementary departments, affords the executive a complete picture of the general activities of all plant employees. Their detailed activities may be secured where any group seems out of line, and all this without recourse to the manufacturing expense report in which non-productive labor is buried, both under its own terminology and under other expense titles as well.

I wish now to refer back to one term which I have used, with respect to the weekly labor analysis which I have just discussed. The term is "time allowed." As a matter of fact we are more accustomed to using the words "Standard Hour" when speaking of the figures found in the time allowed column.

About a year ago we decided to install a Standard Cost System, and we were fortunate in securing for this work one of your former presidents, Mr. R. W. Darnell. As a result of the work upon standard costs and time allowed, there developed not only the standard hour but certain uses of the standard hour, which I believe may be interesting to you and which have a certain bearing upon the subject of this paper.

Production changes have usually been measured by accountants and production men by the productive hour, on the assumption that production would increase or decrease more or less in direct proportion with the increase or decrease of the productive hours. This assumption cannot be accepted as accurate. For instance, when increasing the force, productive hours necessarily increase but due to lack of skill on the part of new operators, production does not increase proportionately, and the contrary is the case when there is a decrease in production, since it is customary to lay off the least efficient operators, which results in a decrease of productive hours out of proportion to the decrease in production. Productive hours do not take into consideratin the efficiency of the operators. Two operators working the same number of hours may produce widely divergent results.

In setting rates for use in wage incentive systems, regardless of the system, time allowed to complete the task must first be de-

termined, to be converted later into piece rates on a piece work system, and as task time in systems based on time only. The rates as set represent 100% efficiency on the part of the operator where he equals the standard in his performance, that is, 100% is the rate or standard as established by the company. This does not mean that he may not produce at a rate greater or less than the established 100%. As a matter of fact rates are so set that it is expected that the better operators will materially exceed this.

From the wage incentive rates we have developed a unit of measure which we call the "Standard Hour." Wage incentive rates established under a system based upon time are ordinarily expressed in time allowed per piece. The Standard Hour is a measure of the amount of work which should be accomplished in one hour, using time allowed as a basis.

The element of time being a constant factor, the standard hour becomes a constant unit of measurement of performance. For instance, an operator is put to work on a task which requires 10 working hours for him to complete. During that 10 hours he produces product valued at 12 standard hours. Therefore, 12 standard hours represents his production and not the 10 working hours he has taken to accomplish the task. He may have taken 8, 9, 10, 11, 12, or even 13 hours at his work, and still only have produced the same quantity of product. It is what he produces in the hours worked that is important and not the hours worked. What is true of individual operators is also true of specific departments and the plant as a whole.

It has been difficult in the past to measure the work of a department doing a great variety of work where nothing is complete in itself, but only has given operations performed upon the product. By using the standard hour as a measuring stick, an exact knowledge is obtained of just what the department is producing. The standard hour is used as a unit of measurement of the efficiency of operators and departmental and plant efficiency records as illustrated in the Weekly Labor Analysis, and of the production of the various manufacturing departments, as well as a means for the control of inventories. It is impossible to cover specifically all the uses of the Standard Hour as we use it in the control of our manufacturing but I would like to take the time to illustrate its use in the control of man power and machine tool equipment.

As a means of presenting this more clearly I have shown two forms, 2 and 3, one entitled, "Summary of Standard Productive Hours by Departments" and the other "Summary of Standard Productive Hours by Machine Group."

In the Summary of Standard Productive Hours by Department, you will observe that there is a column headed "Standard Hours Per Unit," another, "Yearly Production Schedule," and the third "Total Standard Hours Required." The various products manufactured by the organization are listed on the side and the

Summary of Standard Productive Hours

By Machine Group

L C Smith & Corona Typewriters Inc

Group Name

Dept. Name _____ Dept. No. _____

GROUP NAME _____ NUMBER OF MACHINES _____

DATE

NAME OF PRODUCT	STANDARD HOURS PER UNIT	YEARLY PRODUCTION SCHEDULE	TOTAL STD. HOURS REQUIRED
CORONA MODEL			
No. 3—28 KEY			
No. 3—90 KEY			
No. 3—90 KEY (DEAD)			
No. 3—90 KEY YIDDISH			
No. 4—42 KEY			
ADDING MACHINE—BLACK			
ADDING MACHINE—KRAKALACK			
TYPEWRITER CASE—MODEL No. 3			
TYPEWRITER CASE—MODEL No. 4			
STANDARD HOURS REQUIRED			
EFFICIENCY LOSS OR GAIN			
PLUS SET-UP TIME			
PLUS MACHINE BREAKDOWN			
PLUS OTHER LOST TIME OF MACHINERY			
TOTAL MACHINE CAPACITY REQUIRED			
MACHINE CAPACITY AVAILABLE (2800 HRS. X No. MACH.)			
SURPLUS OR INADEQUATE CAPACITY			

FORM 3

Summary of Standard Productive Hours

By Department

L C Smith & Corona Typewriters Inc

Dept. Name _____ Dept. No. _____

NAME OF PRODUCT	STANDARD HOURS PER UNIT	YEARLY PRODUCTION SCHEDULE	TOTAL STD. HOURS REQUIRED
CORONA MODEL			
No. 3—28 KEY			
No. 3—90 KEY			
No. 3—90 KEY (DEAD)			
No. 3—90 KEY YIDDISH			
No. 4—42 KEY			
ADDING MACHINE—BLACK			
ADDING MACHINE—KRAKALACK			
TYPEWRITER CASE—MODEL No. 3			
TYPEWRITER CASE—MODEL No. 4			
STANDARD HOURS REQUIRED			
EFFICIENCY LOSS OR GAIN	%		
PLUS SET-UP TIME	%		
PLUS REPAIRS, IDLE TIME, ETC.	%		
PLUS LOST TIME OF OPERATORS	%		
TOTAL MAN HOURS REQUIRED			
STANDARD WORKING HOURS PER YEAR			
STANDARD NUMBER OPERATORS REQUIRED			

FORM 2

standard hours per article or unit entered opposite each article. In the second column would appear the production schedule for the year, and in the third column would be entered the product of the first two. From the summation of the third column we would obtain the total number of standard hours required for all these production schedules. It is apparent, however, that the actual number of productive hours required may be greater or less than the standard hours determined. The standard hours required shown thus far are based upon the assumption that all operators will produce at 100% efficiency because standard hours are represented at 100% efficiency. However, it is seldom, if ever, the case that a department will operate at an even 100% efficiency. An efficiency ranging from 90% to 110% or possibly 115% is more likely to be the case. In the event that a department under consideration produces at 90% efficiency, it will require approximately 11% more time to produce the product outlined in the production schedule than is shown under the standard hours required. On the other hand, if a department has an efficiency rating of 110%, it will require approximately 9% less time to produce this schedule, as indicated by the standard hours required. Therefore, in order to arrive at the actual hours required to produce the schedule, it is necessary to take into consideration this element of efficiency of operators, either adding or subtracting, as the case may be, the variable produced by the efficiency rating. Another element of variation from the standard hours required is the amount of set-up time which will be expended during the year to set up the various operations which have been assigned to the department. In the same way the other items are determined as influencing the number of productive hours required in the deparment.

By adding, then, these various elements to standard hours required, the total man hours required to operate the department is obtained. The number of hours to be worked throughout the year being known, the number of operators required in the department for the given production is easily obtained by dividing the working hours per year into the total man hours required.

This same method and substantially the same form may be used for determining the total machine capacity required, and since the machine capacity available is a known factor, there results a surplus or inadequate machine capacity as the case may be.

None of these data which we obtain is in any way essential to cost keeping, but they are of considerable importance to the executives in analyzing labor and machine conditions in their plants. Intelligent use of these data should tend to minimize labor turnover, due to foremen hiring or firing workers unnecessarily because of the rather limited horizon which they possess as to the requirements of their department. It would also assist the factory executives in determining more exactly what departments are over- or under-manned, and to what extent they should be reduced or

FORM 2

FORM 3

enlarged in accordance with the future possibilities of work in the department, as well as to enable them to move operators from one department to another to stabilize and balance production. Use of these data will also eliminate the possibility of unnecessary outlay of capital for machine equipment which would not be used to an extent to justify the expenditure.

Further uses of the standard hour which suggest themselves are: (1) The measurement of production through any department in terms of units of finished product, and (2) Control of in-process and finished parts inventories by resolving all parts into valuation by standard hours.

By referring back to the form "Summary of Standard Productive Hours by Department" we can tabulate for each department the number of standard hours required to produce its schedule. The total number of standard hours actually produced by the department having been ascertained, the over-or under-production of the department may readily be determined and the proper steps taken to remedy the trouble. Through this means a control of inventories may be secured weekly by maintaining a balanced condition between departments.

It is not to be imagined that in a paper of this sort, it is possible to point out in detail the ramifications of the subject, nor is it possible to suggest the manner in which the data available might be used to best advantage by each particular industry. A proper conception of the basic or underlying facts is the first and most important thing. Individual applications may vary, but if the proper standards are set and there is an agreement upon definitions of the terms which we use, regardless of the particular word, it is then possible to make comparisons which have heretofore been impossible, not only within a given organization itself from time to time by department, but with other organizations or industries.